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O-MIF signature in sulfate aerosols from Mexico City

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Since the discovery of mass independent fractionation of sulfur and oxygen isotopes (S- and O-MIF) on Earth, the study of sulfate isotopic composition opened a new and wide field of investigation on the evolution of the atmospheric composition and its consequences for the climate. Sulfate aerosols that have a negative forcing on the climate can therefore be studied via their isotopic composition and leads to better constraints on their formation, fate and sinks, which is essential for our understanding of the sulfur cycle on Earth.

In this study we focus on the interaction between anthropogenic and volcanic emissions that is necessary to figure out the climatic impact of volcanoes in large urban area. For the first time the O- composition of sulfate aerosols was monitored over the past 25 years in one of the world's largest megacities: Mexico City (MC). Sulfate aerosols from the megalopolis were sampled from 1989 to 2013 in different stations by high volume pumps and collected on glass filters. Additionally, fresh volcanic ash samples were collected during recent eruptions (from 1997 to 2013) of the Popocatepetl, which is only 70km from MC. After extraction and purification of sulfate from filters and volcanic ash, the isotopic composition is measured. The sulfate aerosols from MC show O-MIF composition with $\Delta 17O$ of about 0.7‰ during the wet season and around 1.2‰ during the dry season and $\delta 18O$ from -0.4‰ to 17.5‰Ḣowever, the volcanic sulfate aerosols from the Popocatepetl do not show O-MIF and $\delta 18O$ vary from 7.0‰ to 12.2‰.

The dataset allows us to discuss the seasonal variations in the SO_2 oxidation pathways that lead to sulfate aerosol formation in the troposphere above MC during the last 25 years. Furthermore, since 1997 we are able to trace and quantify the influence of volcanic sulfate aerosols on the megalopolis, which is important for the sulfur budget in the region.